

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

TAKAURA ET AL

Application No.: 10/588,647

Art Unit: 1793

Filing date: June 15, 2007

Examiner: Weiping Zhu

For: SOLDER PASTE

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir:

I, KAICHI TSURUTA, declare as follows:

I am one of the inventors of the present application. I have been employed by Senju Metal Industry Co., Ltd., which is the assignee of the present application, since 1983. I have a degree in Ph.D in Engineering from UTSUNOMIYA University in Tochigi, Japan. I currently work in the Solder Research and Development Department of Senju Metal in Tochigi, Japan, where I am involved in research and development of Soldering. I am an inventor of more than 20

patent applications related to Soldering and soldering materials.

I have read the disclosure of US 2006/0021466 A1 by Goudarzi et al (referred to below as Goudarzi). Goudarzi is the publication of U.S. Patent Application No. 11/209,076. This application claims the priority of U.S. Patent Application No. 10/334,132. For reference, I have also read the disclosure of JP 2006-512212 A1.

This is the publication of Japanese Patent Application JP 2004-565730, which is the national phase in Japan of PCT/US2003/041326, which claims the priority of U.S. Patent Application No. 10/334,132. Therefore, JP 2006-512212 A1 is the Japanese counterpart of Goudarzi.

In this declaration, I will analyze the permissible level of In in Goudarzi from the standpoint of a person with considerable experience in the design of solder alloys.

Goudarzi discloses a mixed alloy lead-free solder paste. The paste includes a first alloy and a second alloy. The first alloy contains at least Sn and Ag. According to paragraphs 0019 0020 of Goudarzi, the first alloy may comprise Sn, Ag, and at least one additional metal selected from the group consisting of Cu, Zn, Bi, Ni, and In. Preferably the additional metal is Cu.

According to paragraph 0021 of Goudarzi, in one embodiment, the first alloy comprises Sn, Ag, Cu, and a fourth metal which does not substantially increase the difference between the solidus

and liquidus temperatures of the first alloy. The fourth metal is preferably selected from the group consisting of Zn, Bi, Ni, and In. The fourth metal is preferably Bi. According to paragraph 0021, the content of the fourth metal is from about 0.1 wt % to about 5 wt %. Goudarzi does not say whether the maximum and minimum content of the fourth metal is the same for each of Zn, Bi, Ni, and In. If paragraph 0021 means that the maximum permissible content of the fourth metal is the same for any of Zn, Bi, Ni, and In, then the maximum In content of the first alloy is 5 wt % when the first alloy of Goudarzi is Sn-Ag-Cu-In.

Goudarzi discloses only two specific examples for the first alloy. These are SnAgCu and SnAgCuBi. Goudarzi does not disclose any specific alloy containing In, and it does not disclose what the In content should be if the first alloy is SnAgIn.

However, based on the maximum permissible In content when the first alloy is SnAgCuIn in paragraph 0021 and principles of metallurgy, it is possible to draw a conclusion about the maximum permissible In content when the first alloy is SnAgIn.

Cu is normally added to an SnAg alloy for the purpose of providing strength. See, for example, Sn-3.0Ag-0.5Cu. Cu also has the effect of increasing the melting temperature of an alloy. See, for example, Sn-3.0Ag-0.5Cu.

In has a relatively low melting point. According to the

Condensed Chemical Dictionary, elemental In has a melting point of only 156°C. Therefore, In is normally added to an alloy in order to lower the melting point of the alloy.

Thus, Cu and In have opposite effects on the melting point of an alloy. Cu increases the melting point and In decreases the melting point.

Above-mentioned paragraph 0021 of Goudarzi does not explain the reason why the upper limit on Zn, Bi, Ni, or In is 5 wt % when added as a fourth metal to a Sn-Ag-Cu alloy. Unless the limitation is totally arbitrary, the reason must be based on the effect of the fourth metal, and it must be the case that a desired result is not obtained if the content of the fourth metal is greater than 5 wt %.

Since Cu and In have opposite effects, it is necessary to adjust the In content of the first alloy based on the Cu content of the first alloy in order to obtain the desired result desired.

This means that if the Cu content of the first alloy is decreased, the In content of the first alloy must also be decreased to achieve the desired result. If Cu is eliminated from the first alloy (e.g., if the first alloy is SnAgIn), the content of In in the first alloy must be less than the maximum permissible content of In when the first alloy is SnAgCuIn. If paragraph 0021 of Goudarzi means that the maximum permissible content of In is 5 wt % when the first alloy is a SnAgCuIn alloy, then the maximum permissible content

of In must be less than 5 wt % when the first alloy is a SnAgIn alloy. An In content of 5 wt % in this case would be contrary to the logic of paragraph 0021 of Goudarzi.

Therefore, if Goudarzi is logically consistent, then the In content of the first alloy can never be greater than 5 wt % and must be lower when the first alloy is SnAgIn than when the first alloy is SnAgCuIn.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

inventor's name

Kaichi Tsuruta, Japan

Date: Oct.20.2011

*Kaichi Tsuruta*